Attorney Docket No. SP

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

Inventor:	BHAGAVATULA, *et al.*	
Serial No:	09/812,108	Art Group Unit: 2839
Filing Date:	March 19, 2001	Examiner: Chandrika Prasad
Title:	Optical Fiber Lens and Method for Fabrication	**PETITION TO WITHDRAW HOLDING OF ABANDONMENT**

Commissioner for Patents
P.O. Box 1450
Mail Stop: Issue Fee
Alexandria, VA 22313-1450

PETITION TO WITHDRAW HOLDING OF ABANDONMENT PURSUANT TO 37 CFR §1.181 AND MPEP §711.03(c)(I)

The Office issued a Notice of Abandonment in the above-entitled application dated March 11, 2004 based upon Applicant's failure to timely file new formal drawings when responding to the Notice of Allowance and paying the Issue Fee. However, Applicant had previously submitted that formal drawing. Accompanying this petition, Applicant provides evidence of that prior submission sufficient according to MPEP §503 (Postcard Receipt as Prima Facie Evidence) and/or 37 CFR §1.8(b) (Certificate of Mailing). As such, Applicant respectfully contends that the above-captioned application was not abandoned for failing to respond to an action or requirement of the Examiner, and the Notice of Abandonment should be withdrawn pursuant to 37 CFR §1.181 and MPEP §711.03(c)(I). Applicant therefore petitions for the withdrawal of the holding of abandonment pursuant to those provisions. No fee is believed necessary for this petition.

1. Statement of Relevant Facts

In the Office Action dated March 6, 2003, the Examiner objected to the drawings because Figures 20 and 21 did not contain reference sign 46 mentioned in the description.

The Examiner requested a proposed drawing correction *or* corrected drawing. (Off. Action of 03/06/04, Paper #10, page 2.)

Accompanying the Response dated September 4, 2003, Applicant filed *both* a drawing sheet showing the proposed drawing corrections to Figures 20 and 21 identified in red on that sheet and labeled as Annotated Sheet Showing Change(s), *and* a formal drawing sheet of those corrected drawings labeled Replacement Sheet 7/8.

The return-receipt postcard accompanying the Response identifies that two pages of drawings were submitted with the Response. The Response identifies that Amendments to the drawings include one attached Replacement Sheet,[1] and on page 14 the "Amendment to the Drawings" section states in full:

> The attached sheet of drawings includes changes to Figs. 20 and 21. This sheet, which includes Figs. 20 and 21, replaces original sheet including Figs. 20 and 21. In Figure 20, previously omitted element 46 has been added. In Figure 21, previously omitted element 46 has been added.
>
> Attachment: Replacement Sheet
> Annotated Sheet Identifying Changes

The two drawing sheets are separately titled "Annotated Sheet Showing Change(s)" and "Replacement Page 7/8."

The Response bears a certificate of mailing dated September 4, 2003, and the signature of the undersigned attorney. In addition, a proper Request for Extension of Time was filed with that Response, also bearing the September 4, 2003 certificate of mailing, and as identified in the return-receipt postcard.

Copies of the Response bearing the certificate of mailing, the return-receipt postcard bearing the Office's mail room stamp, the drawing sheet of proposed drawings corrections, the formal Replacement Sheet 7/8, and the time extension accompanying the Response are enclosed with this petition for the Office's review.

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1 Page 1 of the Response erroneously indicates that the description of the drawing corrections begins on page 13, whereas it actually begins on page 14. This is not believed to affect the merits of the Response or this petition.

2. Basis for Petition

Applicant respectfully suggests that the Examiner's requirements regarding correction of the drawings were fully met in the Response dated September 4, 2003, and that a sheet of formal replacement drawings was timely filed. As such, Applicant believes that all actions or requirements issued by the Examiner were timely complied with, and the holding of abandonment in the above-caption application was in error.

The undersigned apologizes for not bringing the oversight regarding Item 8 in the Notice of Allowability to the Examiner's attention when paying the Issue Fee. However, as the Examiner's requirements regarding the drawings were fully met prior to issuance of the Notice of Allowability, the undersigned respectfully suggests that any failure to point out this oversight to the Examiner does not constitute a lack of a response to an action or requirement within the meaning of 37 CFR §1.181 and MPEP §711.03(c)(I).

Applicant believes that the attached documents provide evidence satisfactory according to the standards imposed by MPEP §503 (Postcard Receipt as Prima Facie Evidence) and/or 37 CFR §1.8(b) (Certificate of Mailing) to show that Applicant timely complied with the Examiner's requirements regarding the correction of drawings, and

3. Request for Relief

Based upon the above statements of fact as evidenced by the attached documents, Applicant petitions pursuant to 37 CFR §1.181 and MPEP §711.03(c)(I) for the Office to withdraw the holding of abandonment in this application, and proceed to issue the corresponding patent in due course.

Should for any reason the Office have misplaced the Replacement Sheet 7/8 of the formal drawings, and the enclosed copy is insufficient, Applicant has included a clean set of corrected formal drawings (with sheet 7/8 not marked as a replacement page). If these are unsuitable for any reason, or if the Office requires additional information, documents, or drawing sheets, Applicant requests that the Office contact the undersigned attorney or issue a supplemental action and allow Applicant an appropriate period to respond.

If for any reason the Office deems this petition to not meet any substantive requirements of the Rules or statute, or the attached evidence to be insufficient, Applicant

requests that the Office so notify the undersigned of such reasons and provide an opportunity to cure such defects, or to submit an appropriate petition for the revival of the application pursuant to other Rules of the Office.

Please direct any inquiries or communications regarding this application to Corning attorney **Timothy Schaeberle** at **(607) 974-3164**, or regarding this petition to Phil Alden at (607) 974-8803.

Respectfully submitted,

CORNING INCORPORATED
by ~~its attorney~~,

Date: March 17, 2004

Philip G. Alden, Reg. No. 32,189

CERTIFICATE OF EXPRESS MAILING UNDER 37 CFR §1.08:
I hereby certify that this paper and any papers referred to herein are being deposited with the U.S. Postal Service, first class mail, postage prepaid, addressed to the Assistant Commissioner of Patents, Arlington, Virginia 22313-1450 on March 17, 2004.

Philip G. Alden ______________________
Signature

COPY

Division SM   Date 9/4/03

INVENTOR Bhaga[illegible]la et al

CASE No. SP00-095

SERIAL No. 09/812,108

FILED 3-19-01

ATTORNEY PGA

The Patent and Trademark Office acknowledges and has stamped hereon the date of receipt of the items checked below:

- ☐ ____ PAGES, PROVISIONAL APPLICATION PAPERS
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- TOTAL CLS. ________ FEE $ ________
- ☐ ________ SHEETS OF DRAWINGS
- FORMAL/INFORMAL   FIGURE NOS. ________
- ☐ ASSIGNMENT   ☐ DECLARATION/OATH
- ☐ POWER OF ATTORNEY
- ☐ PRIOR ART STATEMENT
- ☐ LETTER - CHARGE DEPOSIT ACCOUNT
- ☒ AMENDMENT   ☐ RESPONSE
- ☐ ISSUE FEE
- ☐ CERT. OF CORR.   ☐ NOTICE OF ERROR
- ☐ REQUEST   ☐ DEMAND
- ☐ INVITATION TO CORRECT
- ☒ 2 Spefication preplacement pages
- ☒ 2 Replacement drawing pages
- ☒ Time Extension (3 mo) w/fee
- ☐ ________

EXPRESS MAIL # ________

ET-149137

ivision SM   Date 9/4/03

NVENTOR Bhagavatula et al

ASE No. SP00-095

ERIAL No. 09/812,108

ILED 3-19-01

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-] INVITATION TO CORRECT
-] 2 Spefication preplacement pages
-] 2 Replacement drawing pages
-] Time Extension (3 mo) w/fee
-] ________

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ET-149137

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PATENT
U.S. Attorney Docket No.: SP00-095

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor:	BHAGAVATULA VENKATA A, et al.	
Serial No:	09/812108	Art Group Unit: 2839
Filing Date:	3/19/2001	Examiner: Webb, B.S.
Title:	OPTICAL WAVEGUIDE LENS AND METHOD OF FABRICATION	

Commissioner of Patents
Alexandria, VA 22313-1450

REQUEST FOR EXTENSION OF TIME TO RESPOND TO OFFICIAL ACTION

Applicants, through counsel, respectfully request a three (3) month extension of time pursuant to 37 C.F.R. § 1.136(a), or such other extension of time as is necessary, to respond to the Office Action dated March 6, 2003 currently due . Please charge the fee of $930.00, and any additional fees or surcharges necessary to make this response timely, to the deposit account of the undersigned corporation, Deposit Account No. 03-3325, and credit any overpayment.

Respectfully submitted,

Date: 9/4/03

Attorney/Agent for Assignee
Philip G. Alden
Reg. No.: 32,189
Corning Incorporated
SP-TI-3-1
Corning, NY 14831
607-974-8803

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8: I hereby certify that this paper and any papers referred to herein are being deposited with the U.S. Postal Service, as first class mail, postage prepaid, addressed to the Commissioner of Patents, Alexandria, Va 22313-1450 on 9/4/03.

Philip G. Alden(Signature)

Revision: August 30, 2002
E:\MDC Forms\Extension of Time Request 5-1-03.dot

COPY

Appl. No.: 09/812,105
Amdt. Dated: September 4, 2003
Reply to Office Action of: March 6, 20

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	09/812,105
Applicant	:	Corning Incorporated
Filed	:	March 19, 2003
Title	:	Optical Fiber Lens and Method for Fabrication
TC/A.U.	:	2839
Examiner	:	Webb, B.S.
Docket No.	:	SP00-095

CERTIFICATE OF MAILING (37 CFR 1.8a)

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Mail Stop: Non-Fee Amendments, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on September 4, 2003

Philip G. Alden

Mail Stop: Non-Fee Amendments
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Office action of March 6, 2003, please amend the above-identified as follows:

Amendments to the Specification begin on page 2 of this paper and include two attached replacement sheets..

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Amendments to the Drawings begin on page 13 of this paper and include one attached replacement sheet.

Remarks/Arguments begin on page 14 of this paper.

Amendments to the Specification

The attached two replacement pages 5 and 13 replace prior pages 3 and 14 and amend the terms “mole percent” and “mol%” to read “weight percent” and “wt%,” respectively.

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) An optical waveguide lens for collimating or focusing a light beam, the light beam having a mode field diameter measured at a beam waist when the light is transmitted through the optical waveguide lens into free space, the optical waveguide lens comprising:

an optical waveguide having an end through which the light propagates and a diameter; and

a lens member connected to and extending from the end of the optical waveguide, the lens member having a throat portion and a generally spherical lens portion, the throat portion having a cross-sectional dimension substantially greater than the diameter of the optical waveguide.

2. (Original) The optical waveguide lens of claim 1 wherein the optical waveguide has a core and a cladding, the core being fabricated from a doped glass having a softening point, and wherein the lens member is fabricated from a generally homogenous glass having a softening point less than the softening point of the core of the optical waveguide.

3. (Original) The optical waveguide lens of claim 1 wherein the lens member is fabricated from a generally homogenous glass including a borosilicate glass.

4. (Original) The optical waveguide lens of claim 1 wherein the lens member is fabricated from a 4 weight percent borosilicate glass.

5. (Original) The optical waveguide lens of claim 1 wherein the optical waveguide has a diameter on the order of 125 microns and the cross-sectional dimension of the throat portion is greater than 135 microns.

6. (Original) The optical waveguide lens of claim 1 wherein the optical waveguide has a diameter on the order of 125 microns and the cross-sectional dimension of the throat portion is greater than 200 microns.

7. (Original) The optical waveguide lens of claim 1 wherein the cross-sectional dimension of the throat portion of the lens member is about 1.5 or more times diameter of the optical waveguide.

8. (Original) The optical waveguide lens of claim 1 wherein the mode field diameter of the light beam measured at the beam waist is greater than 30 microns.

9. (Original) The optical waveguide lens of claim 1 wherein the mode field diameter of the light beam measured at the beam waist is greater than 120 microns.

10. (Original) The optical waveguide lens of claim 1 wherein the mode field diameter of the light beam measured at the beam waist is greater than 200 microns.

11. (Original) The optical waveguide lens of claim 1 wherein the mode field diameter of the light beam measured at the beam waist is greater than 500 microns.

12. (Original) The optical waveguide lens of claim 1 wherein the mode field diameter of the light beam measured at the beam waist is between 200 and 800 microns.

13. (Original) The optical waveguide lens of claim 1 wherein the optical waveguide is selected from a group consisting of a single-mode optical fiber, a multi-mode optical fiber, a polarization-maintaining optical fiber, a dual-core optical fiber, a separable-core

optical fiber, a circular cross-section optical fiber, and a non-circular cross-section optical fiber.

14. Canceled.

15. Canceled.

16. Canceled.

17. Canceled.

18. (Original) An optical waveguide lens for collimating or focusing a light beam, the optical waveguide lens comprising:

an optical waveguide having a core, a cladding, and an end through which the light propagates, the core being fabricated from a glass having a softening point; and

a lens member connected to and extending from the end of the optical waveguide, the lens member having a generally spherical lens portion, the lens member being fabricated from a glass having a softening point that is less than the softening point of the core of the optical waveguide.

19. (Original) The optical waveguide lens of claim 18 wherein the optical waveguide has an axis, and the lens member has a generally uniform refractive index which does not vary in a radial direction measured relative to the axis of the optical waveguide.

20. (Original) The optical waveguide lens of claim 18 wherein the lens member is fabricated from a generally homogenous borosilicate glass.

21. (Original) The optical waveguide lens of claim 20 wherein the lens member is fabricated from a 4 weight percent borosilicate glass.

22. (Original) A method for fabricating an optical waveguide lens for collimating or focusing a light beam, the method comprising the steps of:

providing an optical waveguide having an end through which the light beam is transmitted, a diameter, and an axis;

providing a lens blank, the lens blank having a face defining a cross-sectional dimension substantially greater than the diameter of the optical waveguide, the lens blank having a softening point;

attaching the lens blank to the optical waveguide such that the end of the optical fiber contacts and is fused to the face of the lens blank;

heating a portion of the lens blank above the softening point;

applying tension to the lens blank such that the lens blank is drawn and separated to form a tapered distal end connected to and extending from the optical waveguide; and

heating the tapered distal end of the lens blank above the softening point such that a generally spherical lens portion having a diameter is formed in general alignment with the axis of the optical waveguide and through which the light beam is transmitted, and such that a throat portion of the lens blank disposed between the optical waveguide and the generally spherical lens portion has a cross-sectional dimension substantially greater than the diameter of the optical waveguide and substantially less than the diameter of the generally spherical lens portion.

23. (Original) The method of claim 22 wherein the lens blank is a generally homogenous borosilicate glass.

24. (Original) The method of claim 23 wherein the lens blank is a 4 weight percent borosilicate glass.

25. (Original) A method for fabricating an optical component wherein a light beam propagates through free space relative to an optical device, the method comprising the steps of:

providing an optical waveguide lens including an optical waveguide having a diameter and an axis, a throat portion connected to and extending from the optical waveguide, the throat portion having a cross-sectional dimension substantially greater than the diameter of the optical waveguide, and a generally spherical lens portion connected to and extending from the throat portion, the generally spherical lens portion having a diameter substantially greater than the cross-sectional dimension of the throat portion;

positioning the optical waveguide lens relative to the optical device such that the light beam propagates either from the optical waveguide lens to the optical device or from the optical device to the optical waveguide lens or both; and

securing the optical waveguide lens relative to the optical device.

26. (Original) The method of claim 25 wherein the optical waveguide has a core fabricated from a glass material having a softening point, the optical waveguide lens being fabricated from a glass material having a softening point which is less than the softening point of the core.

27. (Original) The method of claim 25 wherein the optical waveguide lens is fabricated from a borosilicate glass material.

28. (Original) The method of claim 27 wherein the optical waveguide lens is fabricated from a 4 weight percent borosilicate glass.

29. (Original) The method of claim 25 wherein the optical waveguide lens collimates the light beam propagating from the optical waveguide into the free space

30. (Original) The method of claim 25 wherein the optical waveguide lens focuses the light beam propagating from the free space into the optical waveguide

31. (Original) The method of claim 25 wherein the optical device is a passive optical component.

32. (Original) The method of claim 25 wherein the optical device is an active optical component.

33. (Original) The method of claim 25 wherein the optical device is selected from a group consisting of a multiplexing component or a demultiplexing component.

34. (Original) The method of claim 25 wherein the optical device is selected from a group consisting of a switch component, a router component, or an optical add/drop component.

35. (Original) A method for fabricating an optical waveguide lens assembly comprising the steps of:

providing an optical waveguide having a diameter and a distal end;

providing a ferrule defining a bore extending therethrough, the bore having a diameter equal to or greater than the diameter of the optical waveguide, the ferrule having an end surface;

inserting the optical waveguide through the bore such that a segment of the distal end of the optical waveguide is exposed;

forming a lens member on the distal end of the optical waveguide, the lens member including a generally spherical portion;

retracting the optical waveguide through the bore such that a portion of the lens member contacts the end surface of the ferrule; and

securing the optical waveguide in position relative to the ferrule.

36. (Original) A method for fabricating a plurality of generally spherical lenses each having a mounting post extending therefrom, the method comprising the steps of:

providing an elongated stock of a glass material from which the plurality of generally spherical lenses are to be formed, the glass material having a softening point, the elongated stock having a distal end and a cross-sectional dimension;

forming a generally spherical lens on the distal end of the elongated stock by heating the glass material above its softening point such that a portion of the elongated stock forms the spherical lens due in part to a surface tension of the glass material, the generally spherical lens having a diameter substantially greater than the cross-sectional dimension of the elongated stock;

separating the generally spherical lens and a segment of the elongated stock connected to the generally spherical lens from a remaining portion of the elongated stock, such that the segment of the elongated stock connected to the generally spherical lens forms the mounting post for the generally spherical lens; and

repeating the forming step and the separating step to fabricate the plurality of generally spherical lenses each having the mounting post extending therefrom.

37. (Original) A pump multiplexer for combining a first optical signal from a pump light source with a second optical signal from a transmission waveguide into a common optical waveguide, the pump multiplexer comprising:

a first input waveguide having an end, the first input waveguide being optically coupled to the pump light source;

a second input waveguide having an end, the second input waveguide being optically coupled to the transmission waveguide;

a birefringent material having a first face and a second face, the end of the first input waveguide and the end of the second input waveguide being

disposed generally confronting and in optical alignment with the first face of the birefringent material; and

an output waveguide having an end, the output waveguide being optically coupled to the common optical waveguide, the end of the output waveguide being disposed generally confronting and in optical alignment with the second face of the birefringent material, wherein at least one of the first input waveguide, the second input waveguide, or the output waveguide having a generally spherical lens formed on the end thereof.

38. (Original) The pump multiplexer of claim 37 wherein a corresponding one of the first input waveguide, the second input waveguide, or the output waveguide to which the generally spherical lens is attached has a diameter, the generally spherical lens including a throat portion having a cross-sectional dimension substantially greater than the diameter of the corresponding one of the first input waveguide, the second input waveguide, or the output waveguide to which the generally spherical lens is attached, and a generally spherical portion having a diameter substantially greater than the cross-sectional dimension of the throat portion.

39. (Original) The pump multiplexer of claim 37 wherein a corresponding one of the first input waveguide, the second input waveguide, or the output waveguide to which the generally spherical lens is attached has a core fabricated from a glass material having softening point, the generally spherical lens being fabricated from a glass material having a softening point which is less than the softening point of the core.

40. (Original) The pump multiplexer of claim 39 wherein the generally spherical lens is fabricated from a borosilicate glass material.

41. (Original) An optical waveguide lens for collimating or focusing a light beam comprising:

an optical waveguide having an end through which the light propagates and a diameter; and

a lens member connected to and extending from the end of the optical waveguide, the lens member having a generally spherical lens portion, the lens member being fabricated from a borosilicate glass.

42. (New) An optical waveguide lens for collimating or focusing a light beam, the light beam having a mode field diameter measured at a beam waist when the light is transmitted through the optical waveguide lens into free space, the optical waveguide lens comprising:

an first optical waveguide having an end through which the light propagates and a diameter;

a lens member connected to and extending from the end of the optical waveguide, the lens member having a throat portion and a generally spherical lens portion, the throat portion having a cross-sectional dimension substantially greater than the diameter of the optical waveguide; and

a second optical waveguide connected to and extending from the throat portion of the lens member, the second optical waveguide being generally parallel with the first optical waveguide.

43. (New) The optical waveguide of claim 42 wherein the first optical waveguide and the second optical waveguide are spaced apart a distance from one another at or generally proximate to the lens member.

44. (New) The optical waveguide of claim 42 wherein the first optical waveguide and the second optical waveguide are in contact with one another at or generally proximate to the lens member.

45. (New) The optical waveguide of claim 42 wherein the first optical waveguide and the second optical waveguide are in contact and formed integrally with one another, the first

optical fiber being selectively separable from the second optical fiber along at least a portion thereof.

46. (New) An optical waveguide lens assembly for collimating or focusing a light beam, the optical waveguide lens assembly comprising:

an optical waveguide having a core, a cladding, and an end; and

a lens member connected integrally to the end of the optical waveguide, the lens member having a throat portion and a lens portion, the optical waveguide being connected to the throat portion, the throat portion having a cross-sectional dimension that differs substantially from the diameter of the optical waveguide at or proximate to a point where the throat portion is connected to the end of the optical waveguide.

47. (New) The optical waveguide lens assembly of claim 46 wherein the core of the optical waveguide is a glass having a softening point, and wherein the throat portion of the lens member is a glass having a softening point that is less than the softening point of the core of the optical waveguide.

48. (New) The optical waveguide lens assembly of claim 47 wherein the lens member is fabricated from a borosilicate glass.

49. (New) The optical waveguide lens assembly of claim 48 wherein the borosilicate glass is four weight percent (4 wt%) borosilicate glass.

50. (New) The optical waveguide lens assembly of claim 46 wherein the cross-sectional dimension of the throat portion differs from the diameter of the optical waveguide by eight percent (8%) or more.

51. (New) The optical waveguide lens assembly of claim 46 wherein the cross-sectional dimension of the throat portion differs from the diameter of the optical waveguide by sixty percent (60%) or more.

52. (New) The optical waveguide lens assembly of claim 46 wherein the cross-sectional dimension of the throat portion differs from the diameter of the optical waveguide by ten microns or more.

53. (New) The optical waveguide lens assembly of claim 46 wherein the cross-sectional dimension of the throat portion differs from the diameter of the optical waveguide by seventy-five microns or more.

Amendment to the Drawings:

The attached sheet of drawings includes changes to Figs. 20 and 21. This sheet, which includes Figs. 20 and 21, replaces original sheet including Figs. 20 and 21. In Figure 20, previously omitted element 46 has been added. In Figure 21, previously omitted element 46 has been added.

Attachment: Replacement Sheet
Annotated Sheet Identifying Changes

REMARKS

Claims 1-13 and 18-53 are in the application. Claims 14-17 have been canceled, without prejudice. New claims 42-53 have been added. No original claims were amended.

1. §102 Rejections

Claims 18, 19, and 35 have been rejected under 35 USC §102(b) as anticipated by Konno '438.

Regarding claim 18, in relevant part the Examiner contends that Konno '438 teaches: (a) an optical waveguide having a core fabricated from a glass having a softening point (inherent), and (b) a lens fabricated from glass *having a softening point less than the softening point of the core*. For support of this proposition, the Examiner cites column 8, lines 58-60 and 64-67, which read as follows:

> More specifically, the tip of the optical fiber terminal of this invention is constructed as shown in the FIG. 1(*a*) example. It comprises an SiO_2 fiber lens tip 7, a pigtailed main fiber 8, a ferrule 9 for protecting the tip 7, and a tip lens 10. It is also feasible to omit ferrule 9. FIG. 1(*b*) shows the transmission state of the beam; when the distance to the convergent point of the beam (beam waist) emitted from the SMF main fiber 8 is z, and the refractive index of SiO_2 at the wavelength λ is n, the Gaussian beam expansion for the beam propagating though the fiber lens 7 is shown by Formula 1. (Konno '438, column 8, lines 57-67.)

Konno '438 therefore discloses a standard single mode fiber (SMF) which is presumably fabricated from an SiO_2 glass likely having a germanium-doped core (though optical fibers having other core and cladding dopants were known in 1991), and a lens member also fabricated from an SiO_2 glass.

The cited portions of Konno '438 therefore do not appear to explicitly or implicitly teach a lens member fabricated from a glass that has a softening point less than the softening point of the core of the optical fiber. For this reason, Konno '438 doe not anticipate the invention as recited in claim 18. Claim 19 would be allowable as depending from claim 18.

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Regarding claim 35, in relevant part the Examiner contends that Konno '438 teaches *a method of forming said lens member that includes retracting the ferrule*.

Claim 35 recites a method for fabricating an optical fiber lens assembly including the step of "retracting the optical waveguide through the bore [of the ferrule] *such that a portion of the lens member contacts the end surface of the ferrule*." (Emphasis added.)

The disclosure of Konno '438 appears to teach forming a lens on an optical fiber pigtail and inserting that pigtail into a ferrule. But more importantly, Konno '438 teaches that when the lens assembly is placed into a ferrule, the fiber and lens element are separated from the ferrule by an "optical fiber protecting material 31." (See Konno '438, column 14, lines 54-61; FIG. 25.) This optical fiber protecting material 31 encompasses both the fiber and the lens, and insulates the fiber and lens from contact with the ferrule. The optical fiber protecting material 31 is distinct from the elements of the ferrule

The lens member therefore does not appear to contact the end surface of the ferrule in Konno '438, and claim 35 is not anticipated by Konno '438.

2. §103 Rejections

Claims 1-13, 20, 21, 25-34, and 36-41 have been rejected under 35 USC §103 as being unpatentable over Konno '438 in view of Miller '653.

The Examiner contends that Konno '438 discloses the limitations of claims 18, 19, and 35 as previously discussed, and further discloses several other elements or limitations listed on page 4 of the Office Action. The Examiner states that Konno '438 fails to teach, among other features:

(a) a lens formed from borosilicate glass or 4 wt% borosilicate glass;
(b) a throat portion of the lens member having a diameter greater than the waveguide;
(c) a throat portion of the lens member having a diameter greater than 135 microns;
(d) a throat portion of the lens member having a diameter greater than 200 microns; and

(e) a throat portion of the lens member having a diameter greater than 1.5 times the diameter of the waveguide.

First, Applicant notes that Konno '438 does not in fact teach all of the elements or limitations recited in claims 18 and 35, as discussed above.

Second, Applicant respectfully asserts that the Miller '653 patent should not properly be regarded or applied as an analogous prior art reference.

The ultimate issue is whether the invention as claimed would have been obvious from the combined teachings of the prior art. This legal determination is made against a background of several factual inquiries, one of which is the scope and content of the prior art. *Graham v. John Deere Co.*, 383 U.S. 1 (1966). Determining what is properly the "prior art" is a prerequisite to evaluating whether the differences between the claimed subject matter and the prior art are such that the claimed subject matter would have been obvious to a person of ordinary skill at the time the invention was made. *Id.*

This is frequently framed in terms of whether or not a given prior art reference is properly considered "analogous" (i.e., whether the reference is "too remote to be treated as prior art.") *In re Sovish*, 769 F.2d 738, 226 USPQ 771 (Fed. Cir. 1985); *In re Deminski*, 796 F.2d 436, 230 USPQ 313 (Fed. Cir. 1986); *In re Clay*, 966 F.2d 656, 23 USPQ2d 1058 (Fed. Cir. 1992). Two criteria have evolved for determining whether prior art is analogous: (1) whether the art is from the same field of endeavor, regardless of the problem addressed, and (2) if the reference is not within the inventor's field of the endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved. *In re Deminski, supra*; *In re Clay, supra*.

The Miller '653 reference is clearly not within the Applicant's field of endeavor. The claimed subject matter relates to fabricating a collimating micro-lens which is integrally formed on the end of an optical fiber, and can be used in micro-optic components where light passes from a fiber through an optical element and into another fiber equipped with a similar focusing micro-lens. In contrast, the Miller '653 patent relates to a *bulk* optical lens used in graphics or media projectors, such as a movie projector or slide projector. Although Miller '653 also discusses using the lens in light

projectors that employ LCDs or fiber optic arrays, this is much different than an optical fiber collimator micro-lens. Miller '653 relates to optical projectors in which white light is projected through an intermediate image (e.g., a movie, slide, or LCD), or where an image is generated and transmitted by a light-producing element (e.g., an LCD or fiber optic array). The lens is spaced apart from an electric bulb having a parabolic reflector, not integrally formed on or even fused to an optical fiber.

Applicant respectfully contends that Miller '653 is being cited because it describes a borosilicate glass lens and happens to use the term "fiber," but is not in fact within Applicant's field of endeavor.

Even though Miller '653 is not within Applicant's field of endeavor, it might still be properly combined with Konno '438 *if* Miller '653 were reasonably pertinent to the problem that Applicant was attempting to solve. *In re Deminski*, *supra*; *In re Clay*, *supra*. A reference is reasonably pertinent (even though it may be in a different field of endeavor) if it logically would have commended itself to an inventor's attention when considering the problem due to the subject matter with which the reference deals. *In re Clay*, *supra*. The purposes of both the invention and the reference are important when evaluating whether the reference is reasonably pertinent to the problem the invention attempts to solve. *Id.* If a reference has the same purpose as the claimed invention, the reference relates to the same problem, and this fact supports using the reference in an obviousness rejection because an inventor may well have been motivated to consider the reference when making his invention. *Id.* Conversely, if the reference is directed to a different purpose, the inventor would accordingly have had less motivation or occasion to consider it, and it may properly be regarded as non-analogous. *Id.*

It is readily apparent that Miller '653 is also not reasonably pertinent to the problem that Applicant was attempting to solve. Applicant's invention relates to fabricating a collimating micro-lens on the end of an optical fiber, and to enhancing the fabrication and performance of such an integral lens-fiber assembly. As such, Applicant was concerned with the physical and material characteristics of the fiber and lens elements, the splicing of the glass lens blank to the fiber, the formation of the desired lens shape, and the optical properties of the resulting lens-fiber assembly. In preferred

embodiments, the invention is described with reference to the geometric differences between the fiber and the throat of the lens to which the fiber is spliced, and the relative softening points of the fiber core and lens glasses which are fused together.

In contrast, Miller '653 does not contain any teachings relevant to the attachment, compatibility, or optical performance of an integral lens-fiber assembly. Miller '653 discusses a bulk optic lens that is spaced apart from an electric bulb and parabolic reflector. It is no more pertinent or analogous that a similar lens contained in a flashlight or an automotive headlamp.

For these reasons, Applicant submits that the Miller '653 patent is not analogous art, and its use as a reference in rejecting claims 1-13, 20, 21, 25-34, and 36-41 is therefore not appropriate. Applicant requests that the rejection be withdrawn.

Furthermore, while the Examiner suggests that Miller '653 generally teaches a borosilicate glass lens, there is no teaching or suggestion in the references themselves that would motivate one of skill to use a borosilicate glass when fabricating a lens-fiber assembly. Miller '653 does not suggest any advantage to using a borosilicate glass having a specified softening point relative to the softening point of the core of the corresponding optical fiber, nor of altering the diameter of the lens throat relative to the diameter of the fiber. Miller '653 further does not teach or suggest using a 4 wt% borosilicate glass for any purpose.

Claim 22 has been rejected under 35 USC §103 as being unpatentable over Konno '438 in view of Pan '968.

Applicant respectfully suggests that the teachings of Pan '968 cannot be combined with Konno '438 in this manner, and do not achieve the claimed invention.

First, Pan '968 teaches tapering the end of an optical fiber or lens element, to a diameter smaller than the fiber, but not thereafter forming a larger-diameter spherical or aspherical lens element from that tapered end. Nothing in the Konno '438 or Pan '968 references themselves suggest first forming a tapered element as in Pan '968, and then subsequently using that tapered element to fabricate a larger-diameter collimating lens.

Second, Pan '968 and Konno '438 do not teach or suggest an integral lens-fiber assembly in which the lens throat has a diameter that is substantially different than the diameter of the corresponding fiber.

The combination of Konno '438 and Pan '968 are not taught or suggested by the references. Such a combination is the product of using Applicant's disclosure as a template, and therefore involves impermissible hindsight. Even if combined, the references fail to achieve the invention as claimed. As such, Konno '438 and Pan '968 are not believed to render claim 22 unpatentable.

Claims 23 and 24 have been rejected as under 35 USC §103 as being unpatentable over Konno '438 and Pan '968 in view of Miller '653.

As discussed above, Miller '653 is not believed to be an analogous reference, and further does not teach or suggest the use of a borosilicate glass or particularly a 4 wt% borosilicate glass in fabricating an integral lens-fiber assembly. Its combination with Konno '438 and/or Pan '968 is not supported by the references themselves, and does not achieve the invention as recited in claims 22 or 23 for the same reasons discussed above.

Applicant respectfully requests that the rejections under §103 based upon the Konno '438, Miller '653, and Pan '968 patents should be withdrawn.

3. Allowable Subject Matter and New Claims

Applicant notes the Examiner's allowance of the subject matter of claims 14-17 with appreciation. Claims 14-17 have been canceled, and the corresponding subject matter recited in new claims 42-45, with claim 42 being independent in form. Claims 43 and 44 have been revised relative to claims 15 and 16 to ensure greater clarity in those claims.

New claims 46-53 have been added. Claim 46 is directed to the assembly comprising an optical waveguide and lens member in which the diameter or cross-sectional dimension of the throat portion differs significantly from the diameter of the optical waveguide. Claims 47-49 recite the subject matter of the glass used to form the throat portion of the lens member having a softening point less than that of the core of the optical waveguide, and in particular being a borosilicate glass and a 4 wt% borosilicate

glass. Claims 50-53 recite embodiments in which the difference in diameter is 8% or 10 microns (using a 125 micron diameter optical waveguide as a reference for percentages) and 60% or 75 microns (using the same 125 micron diameter optical waveguide), which are therefore numerically commensurate with examples provided in the specification and recited in claims 5 and 6.

4. Conclusion

Claims 1-13 and 18-53 are believed allowable over the art of record for the reasons discussed above, and reconsideration of those claims is respectfully requested

Based upon the above amendments, remarks, and papers of records, applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Applicant believes that no extension of time is necessary to make this Reply timely. Should applicant be in error, applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Philip G. Alden at 607-974-8803.

Respectfully submitted,

Date: September 4, 2003

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Reg. No. 32,189
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SP-TI-03-1
Corning, NY 14831
607-974-8803

approximately 4.5 mm from the lens surface, implying a 9 mm separation between a pair of collimating lenses having an optical device disposed in between within an optical component.

SUMMARY OF THE INVENTION

One aspect of the present invention is an optical waveguide lens for collimating or focusing a light beam comprising an optical waveguide and a lens member connected to and extending from the end of the optical waveguide, wherein the lens member has a throat portion whose cross-sectional dimension is substantially greater than the diameter of the optical waveguide, and a generally spherical lens portion.

In another aspect, the present invention is an optical waveguide lens including an optical waveguide and a generally spherical lens member, wherein the mode field diameter or beam diameter of a light beam projected from the spherical lens member is greater than 100 μm measured at a displacement from the surface of the spherical lens member corresponding to the beam waist.

A further aspect of the present invention is an optical waveguide lens including an optical waveguide and a generally spherical lens member attached to the optical waveguide, the generally spherical lens being fabricated from a glass having a softening point less than that of the core of the optical waveguide.

In another aspect, the present invention is an optical waveguide lens including an optical waveguide and a generally spherical lens member attached to the optical waveguide, the generally spherical lens being fabricated from a borosilicate glass, and particularly a 4 ~~mole~~ weight percent borosilicate glass.

A further aspect of the present invention is a method for fabricating an optical waveguide lens comprising the steps of providing an optical waveguide, providing a lens blank defining a cross-sectional dimension substantially greater than the diameter of the optical waveguide, fusing the lens blank to the optical waveguide, heating a portion of the lens blank above its softening point, applying tension to the lens blank until it separates to form a segment having a tapered distal end connected to the optical waveguide, and heating the tapered distal end of the lens blank above its softening point such that a spherical lens portion is formed in alignment with the axis of the

28 optical fiber available from Corning Incorporated of Corning, New York, the core 28 is a germania-doped silica.

One glass material which has proven suitable for use as the lens blank 34 in forming the lens member 14 of the optical waveguide lens 10 of this invention is a borosilicate glass, particularly a silica glass doped with 4 ~~mole percent (mol%)~~ weight percent (wt%) of B_2O_3, conventionally referenced as 4 ~~mol%~~ wt% B_2O_3-SiO_2 glass. The borosilicate glass splices well to standard single-mode fibers and other optical waveguides 12, and produces uniform and reproducible lens members 14 with select rates above 90% for a working distance of 4 mm. The use of borosilicate glass improves performance because fusion splicing a silica optical waveguide 12 with a borosilicate glass lens lank 34 causes thermal core broadening (i.e., on the order of 31% for splicing to either SMF-28 or large-effective-area non-zero dispersion shifted optical waveguides 12), which enlarges the mode field diameter and increases the tolerance for lateral misalignment of the optical waveguide 12 to the lens blank 34. Angular alignment must be closely controlled. A comparison of the filament powers used in the fabrication steps described above as between silica, germania-doped silica, and borosilicate glasses is instructive. As one representative example, in the process described above where splicing the optical waveguide 12 to a silica lens blank 34 will require 20-21 watts of filament power or19 watts for germania-doped silica, only 18 watts are required for borosilicate glass. In taper cutting the lens blank 34, the corresponding figures are 26 watts for silica, 24 watts for germania-doped silica, and 21 watts for borosilicate glass. In melt back to form the spherical lens portion 18, the corresponding figures are 31 watts for silica, 26 watts for germania-doped silica, and 24 watts for borosilicate glass. Standard properties of the borosilicate glass include a softening point of 1520 °C, an n_D of 1.457, α of 9×10^{-7} deg^{-1}, an annealing temperature of 999 °C, strain point of 910 °C, elasticity of 9.2×10^{6} psi, α of 4.6×10^{-7} deg^{-1} at the strain point, ln η_0 of –8.793 poise (where η_0 is viscosity at infinite temperature), and Q (activation energy divided by gas constant) of 49520 (K). A plot of viscosity as a function of temperature shows that borosilicate glass has a slope less than that for silica, allowing the use of lower temperatures for fabricating the optical waveguide lens 10 of the present invention.

Referring to Figures 16-18, a method for mounting the optical waveguide lens 10 of the present invention in a ferrule 42 is shown. The ferrule 42 may be any

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REPLACEMENT PAGE

FIG. 19

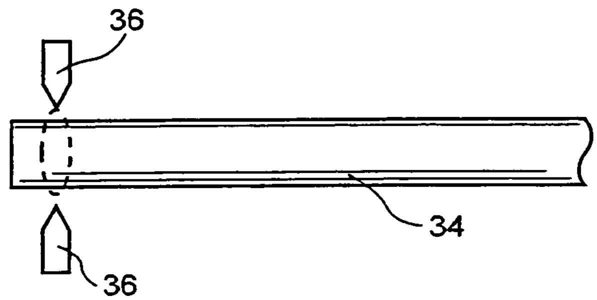


FIG. 20

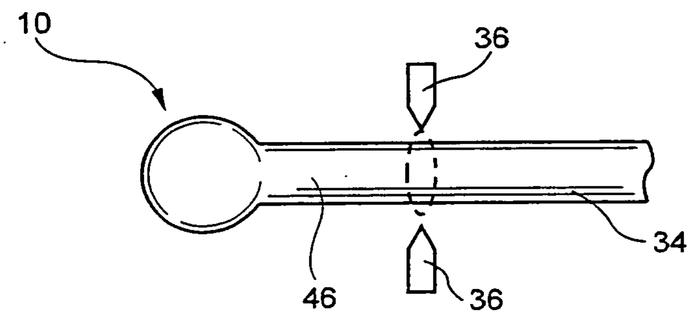


FIG. 21

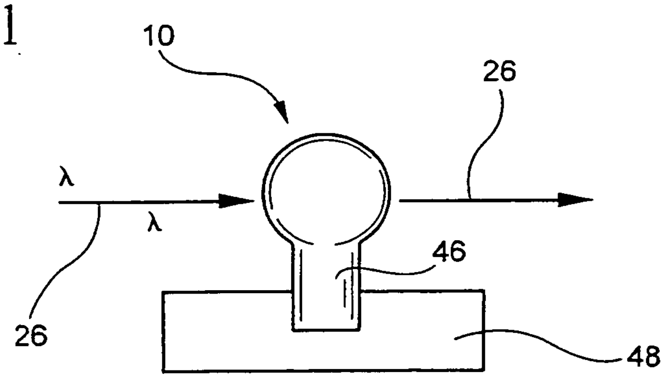


FIG. 19

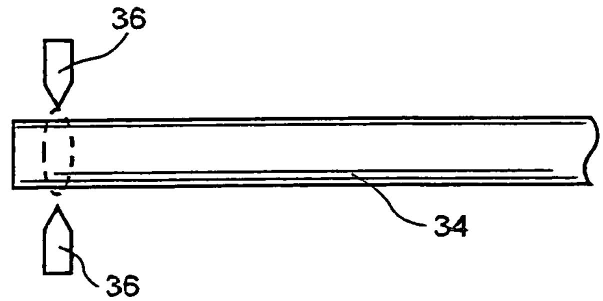


FIG. 20

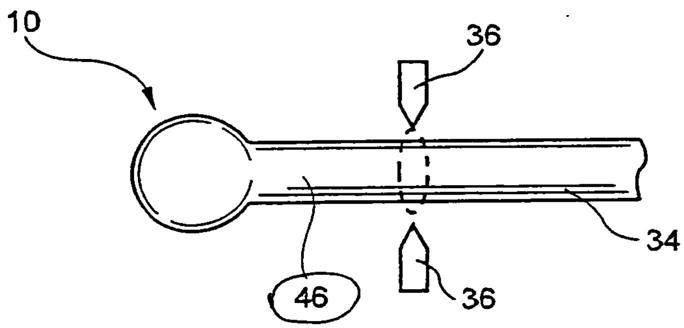


FIG. 21

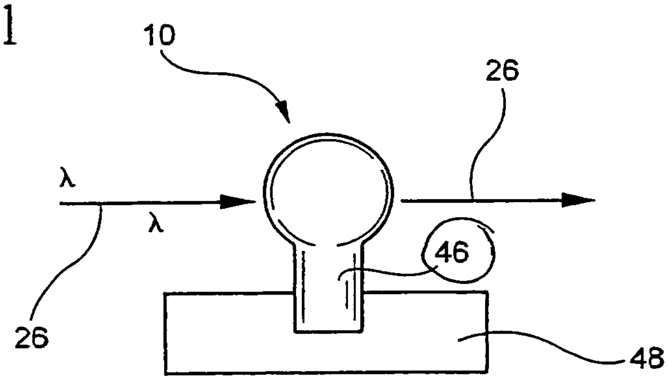


FIG. 1

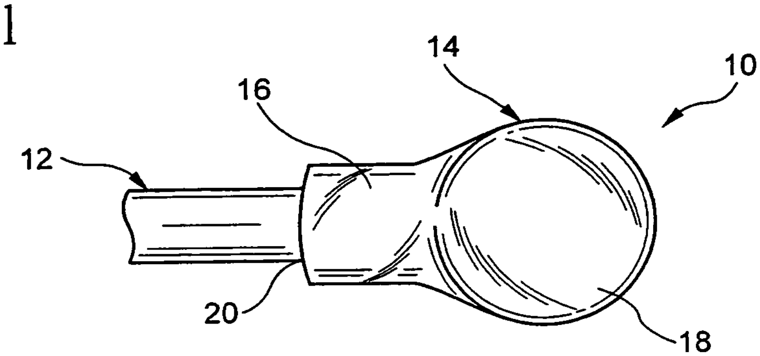


FIG. 2

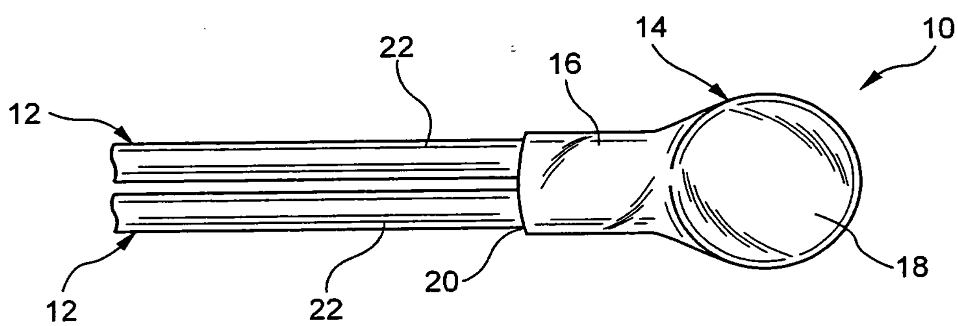


FIG. 3

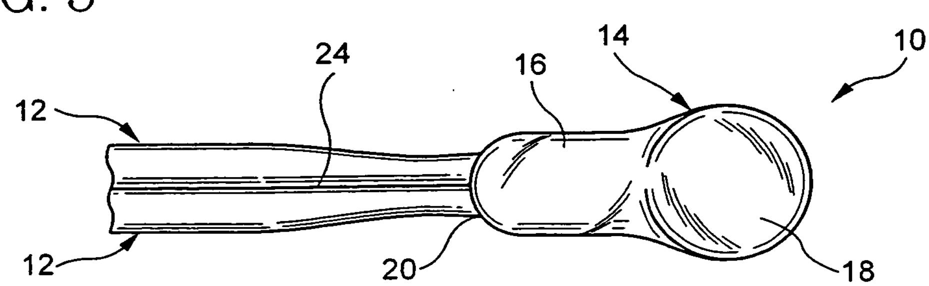


FIG. 4

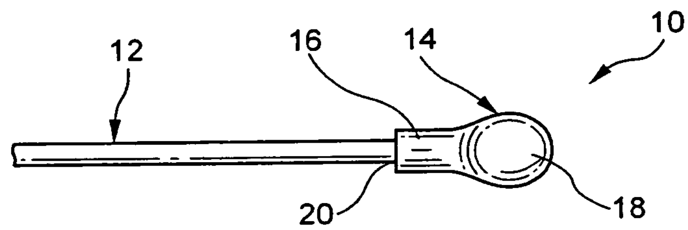


FIG. 5

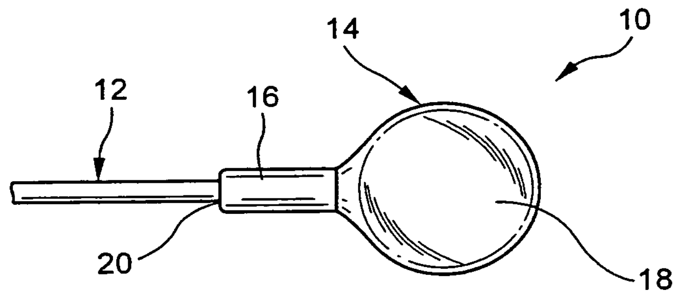


FIG. 6

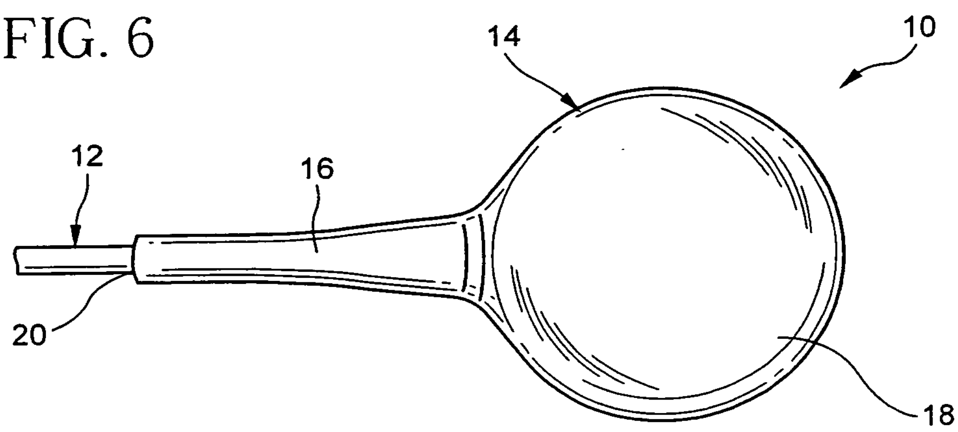


FIG. 7

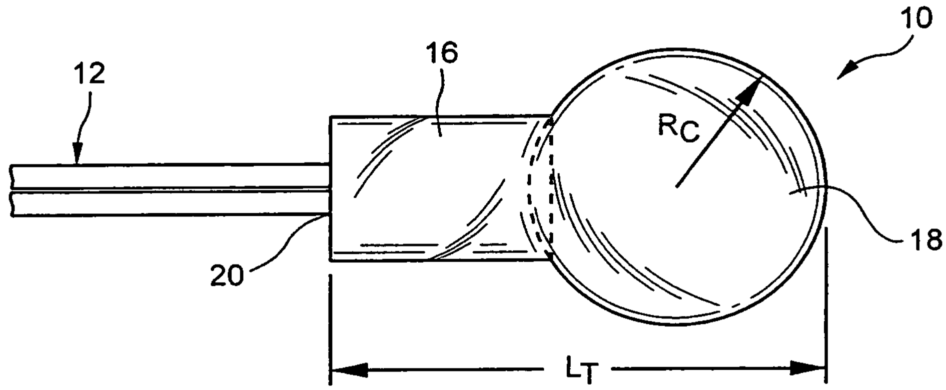


FIG. 8

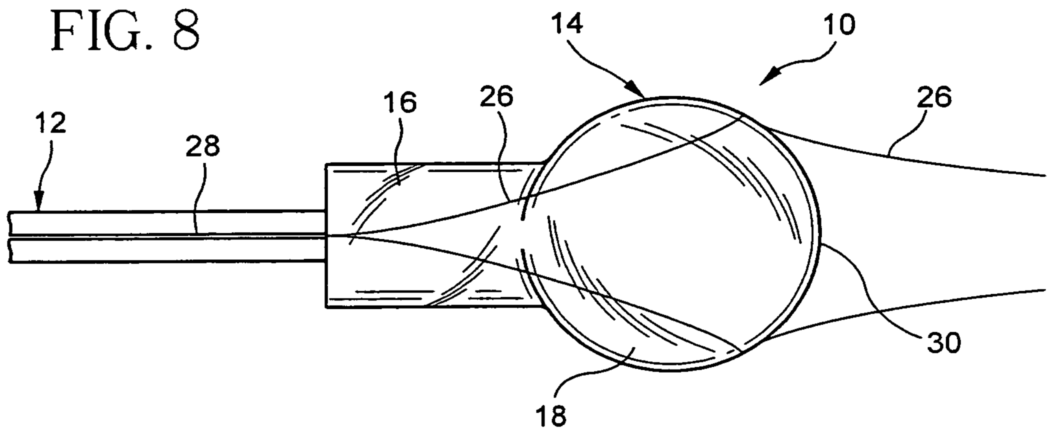


FIG. 9

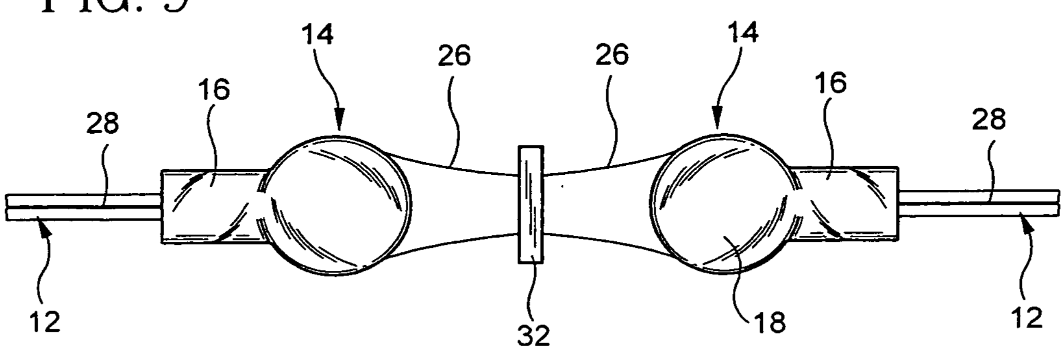


FIG. 10

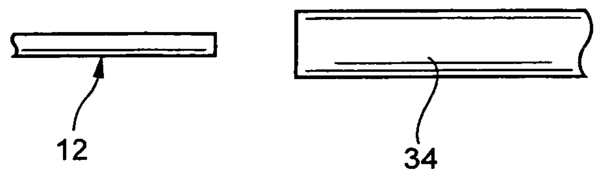


FIG. 11

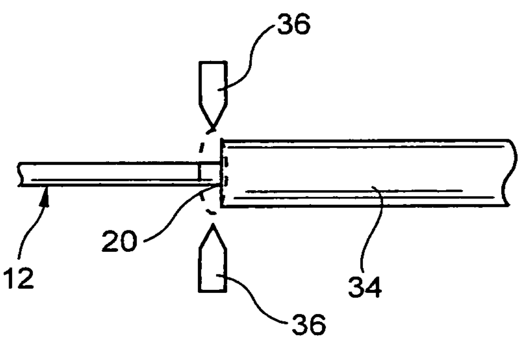


FIG. 12

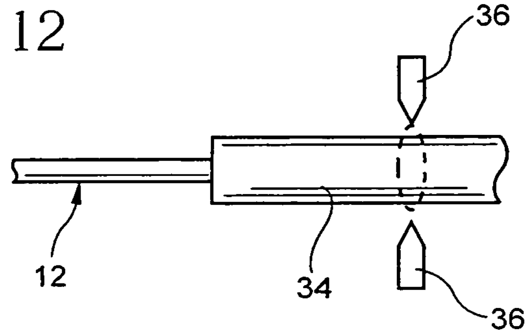


FIG. 13

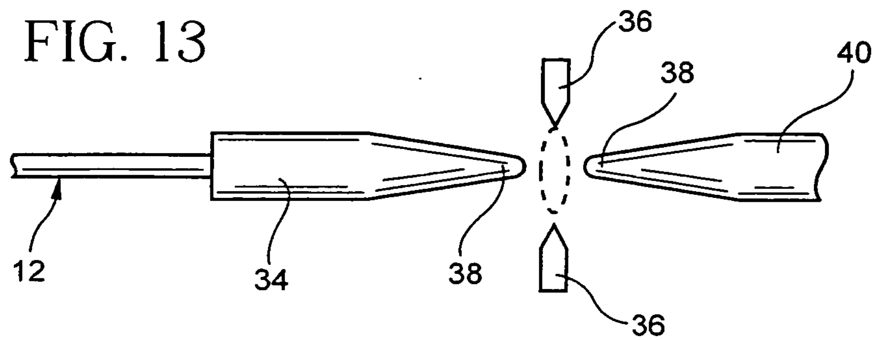


FIG. 14

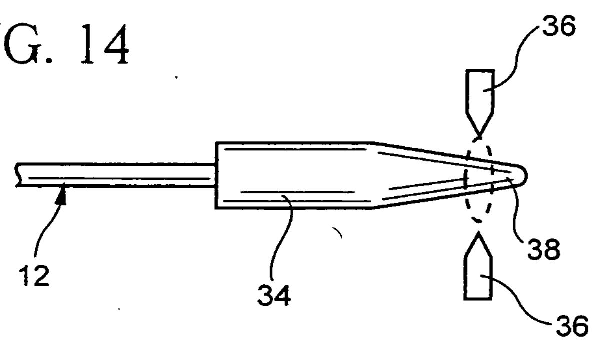


FIG. 15

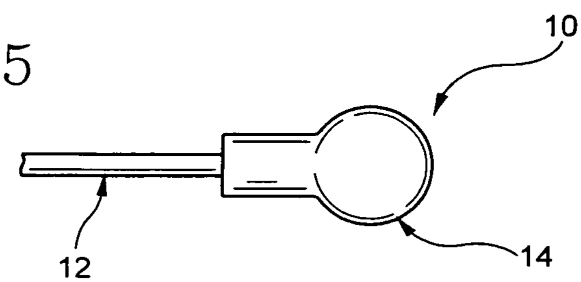


FIG. 16

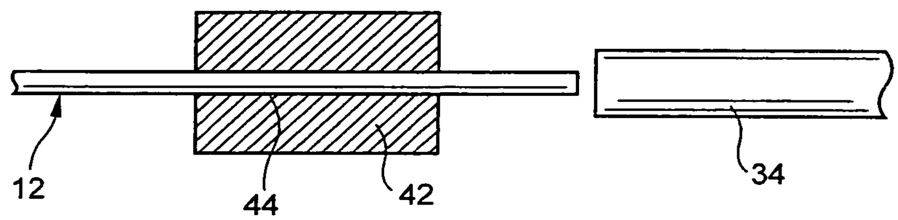


FIG. 17

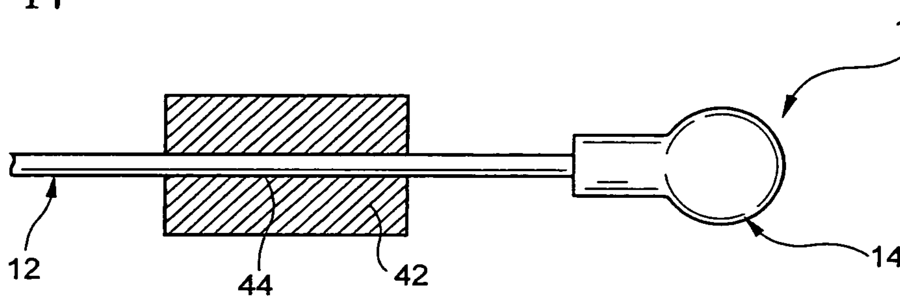


FIG. 18

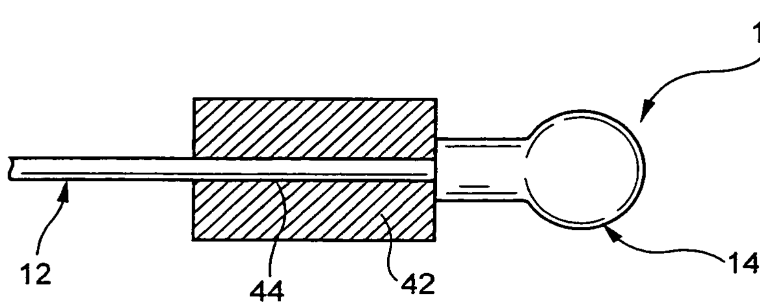


FIG. 19

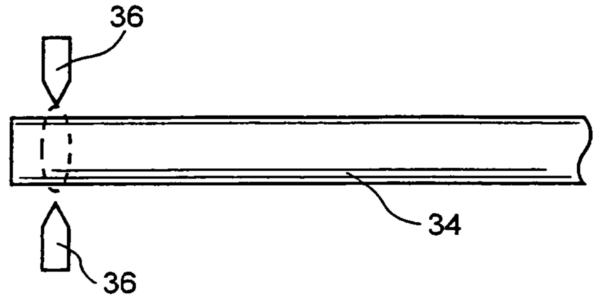


FIG. 20

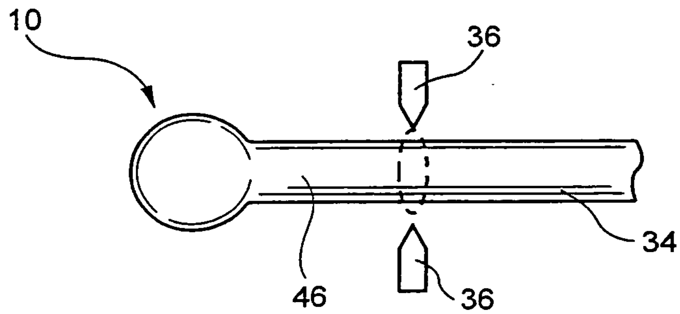
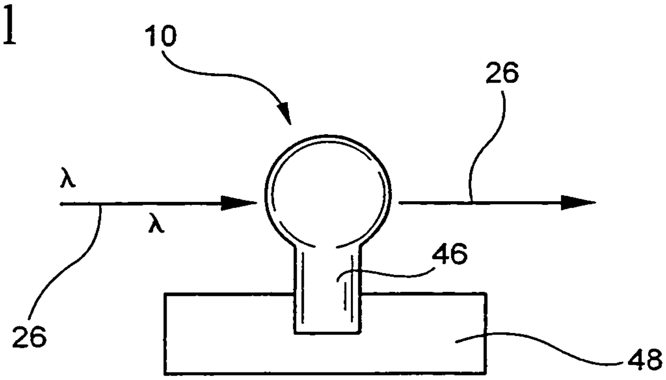


FIG. 21



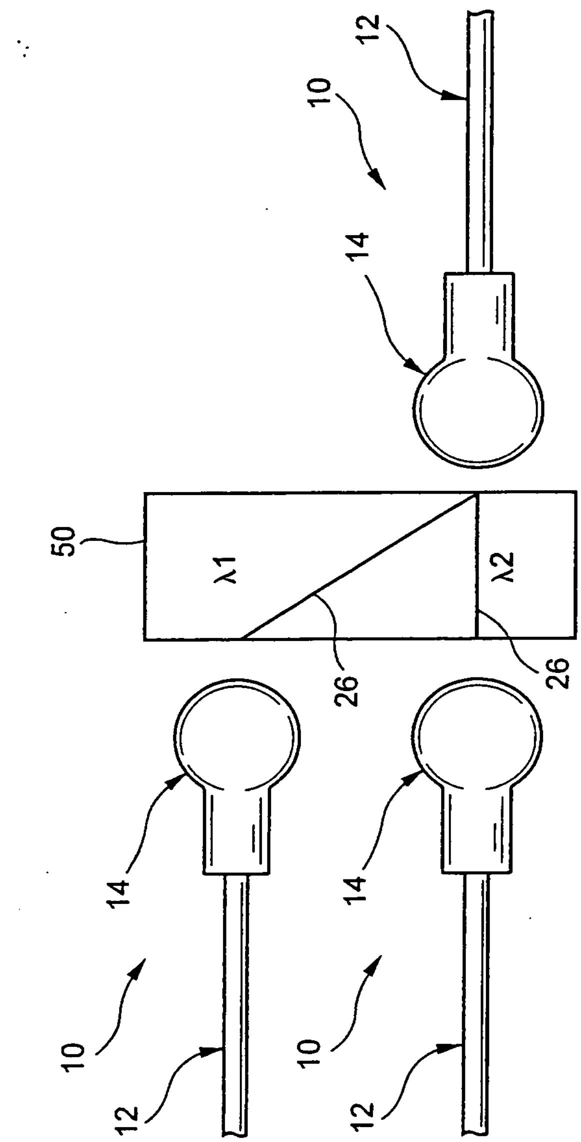


FIG. 22